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DEPARTMENT OF THE ARMY **02210.TD**
CORPS OF ENGINEERS, TULSA DISTRICT **DEC 96**

TULSA DISTRICT GUIDE SPECIFICATION

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SECTION 02210

GRADING

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NOTE: This guide specification covers the requirements for grading, including excavation, filling and shaping of drainage ways. This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-720.

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1 GENERAL

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NOTE: See Additional Notes A and B.

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1.1 REFERENCES

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NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963, R-1990) Particle Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1992) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4253	(1993) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4643	(1993) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method

1.2 DEFINITIONS

1.2.1 Satisfactory Materials

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NOTE: Satisfactory material will be defined in accordance with locally available materials, design slopes, etc., and all suitable classes will be listed in the project specifications in accordance with ASTM D 2487.

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Materials classified in ASTM D 2487 as GW, GP, and SW, GC, GM, SP, SM, SC, AND CL and shall be free from roots and other organic matter, trash, debris, and frozen materials and stones larger than 6 inches 150 mm in any dimension are satisfactory.

1.2.2 Unsatisfactory Materials

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NOTE: Unsatisfactory material will be defined in accordance with locally available materials, design slopes, etc., and all unsuitable classes will be listed in the project specifications in accordance with ASTM D 2487. Inapplicable portions in brackets will be deleted.

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Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Materials classified in ASTM D 2487 as Pt, OH, OL, ML, MH,AND CH and any other materials not defined as satisfactory.

1.2.3 Cohesionless and Cohesive Materials

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NOTE: When classification will be necessary during construction, determination of grain size for classification will be specified to be made in conformance with ASTM C 117, ASTM C 136, or ASTM D 422. ASTM standards selected for use will be listed in paragraph REFERENCES.

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Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Cohesionless materials include materials classified in ASTM D 2487as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.4 Degree of Compaction

Degree of compaction is a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D 1557 or ASTM D 4253. ASTM D 1557 shall be used for soils containing 15 percent or more passing the no. 200 sieve (fines). ASTM D 4253 shall be used for soils containing 5 percent or less fines. The maximum laboratory dry density for soils containing between 5 and 15 percent fines shall be determined by the above procedure yielding the highest laboratory dry density. The percentage of material passing the no. 200 sieve shall be determined in accordance with ASTM D 4253. Degree of compaction shall be expressed as a percentage of the maximum laboratory dry density obtained by the appropriate procedure as defined above. Percentage of maximum laboratory dry density has been abbreviated hereinafter as percent laboratory maximum density.

1.2.5 Nonexpansive Fill

Nonexpansive fill shall be satisfactory material having a plasticity index less than or equal to 12.

1.2.6 Topsoil

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NOTE: Additional requirements such as pH value and necessary soil conditioning, according to applicable provisions of Section 02935 TURF shall be inserted in this paragraph and/or the definition of topsoil. The depth of the topsoil should be given in the text of the specification, preferably in this paragraph.

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Material obtained from [offsite areas] [excavations] [areas indicated on the drawings], suitable for topsoils, is defined as [_____].

1.3 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an

item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space using "GA" where the submittal requires Government approval or "FIO" when the submittal is for information only.

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Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL DESCRIPTIONS:

SD-08 Statements

Field Testing Control; [_____].

Qualifications of the commercial testing laboratory who will be performing all testing in accordance with paragraph FIELD TESTING CONTROL.

SD-09 Reports

Field Testing Control; [_____]. Satisfactory Materials; [_____].

Certified test reports and analysis certifying that the satisfactory materials proposed for use at the project site conform to the specified requirements, and for all tests conducted in accordance with paragraph FIELD TESTING CONTROL.

1.4 SUBSURFACE DATA

Subsurface soil boring logs are [shown on the drawings] . The subsoil investigation report and samples of materials taken from subsurface investigations may be examined at [_____]. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

2 PRODUCTS

2.1 ROCK FOR SLOPE PROTECTION

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NOTE: Where hand placing of the coarse rock is necessary, this provision will be stated definitely in the specification, the brackets will be removed, and the approximate amounts and locations of the hand placing of coarse rock will be indicated. Where hand placing is not required, the inapplicable expression and all brackets will be deleted.

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Coarse rock from excavations shall be conserved and used for constructing the slopes of embankments parallel or adjacent to streams, for constructing slopes or sides and bottom of channels, and for protection against erosion. [Hand placing of coarse rock from excavation will not be required.] [Hand placing of coarse rock from excavation will be required as indicated.]

2.2 BORROW MATERIAL

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NOTE: Where a substantial quantity of borrow excavation is anticipated, the drawings and specifications will, where practicable, indicate the location or locations within the project site and conditions under which it may be obtained. The applicable statements will be retained and inapplicable statements and the brackets will be deleted.

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Borrow material shall be selected to meet requirements and conditions of the particular fill for which it is to be used. Necessary clearing, grubbing, disposal of debris, and satisfactory drainage of borrow pits shall be performed by the Contractor as incidental operations to the borrow excavation.

2.2.1 Selection

Borrow materials shall be obtained from [the borrow areas shown] [or] [sources outside the limits of Government-controlled land] [or] [sources within the limits of Government-controlled land, subject to approval]. Borrow materials shall be subject to approval. [Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval.] [The source of borrow material shall be the Contractor's responsibility. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, shall pay all royalties and other charges involved, and shall bear all the expense of developing the sources, including rights-of-way for hauling.]

2.2.2 Borrow Pits

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NOTE: The requirements for measurement will be deleted when the contract is lump sum.

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Except as otherwise permitted, borrow pits shall be excavated to afford adequate drainage. Overburden and other spoil material shall be disposed of or used for special purposes. Borrow pits shall be neatly trimmed [and left in such shape as will facilitate taking accurate measurements] after the excavation is completed.

3 EXECUTION

3.1 CONSERVATION OF TOPSOIL

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NOTE: Topsoil will be separated, excavated, stored, and used for surface finish in preparation for seeding, sodding, or other planting only where the topsoil is definitely superior for grass and other plant growth as compared to the balance of the excavated materials. Generally, topsoil will be spread after building and other operations have been completed. When topsoil spreading is covered under a separate section of the specifications, this paragraph will be deleted.

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[Where indicated,] topsoil shall be removed to a depth of 6 inches 150 mm without contamination with subsoil and stockpiled convenient to areas for later application or at locations specified. Topsoil shall be removed to full depth and shall be stored separate from other excavated materials and piled free of roots, stones, and other undesirable materials. Any surplus of topsoil from excavations and grading shall be [stockpiled in locations indicated] [removed from the site].

3.2 EXCAVATION

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NOTE: If grouping of materials appears desirable because of existing varying subsurface conditions, as determined by observation or core borings, the specification provisions governing such requirements, including requirements for blasting, if necessary, will be inserted.

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After topsoil removal has been completed, excavation of every description, regardless of material encountered, within the grading limits of the project shall be performed to the lines and grades indicated. Satisfactory excavation material shall be transported to and placed in fill areas within the limits of the work. All unsatisfactory material [including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water] and surplus material shall be [removed from site] [disposed of at locations indicated on the plans] [disposed of in areas approved for surplus material storage]. [In the event that it is necessary to remove unsatisfactory material to a depth greater than specified, the Contracting Officer shall be notified and an adjustment in the contract price will be considered in accordance with the contract.] [Unsatisfactory material excavated below the grade shown and replaced with satisfactory material as directed shall be included in the contract unit price for excavation.] Excavations carried below the depths indicated, without specific directions, shall, except as otherwise specified, be refilled to the proper grade with satisfactory material as directed. All

additional work of this nature shall be at the Contractor's expense. Excavation and filling shall be performed in a manner and sequence that will provide drainage at all times. Excavations shall be kept free from water while construction therein is in progress. Material required for fills in excess of that produced by excavation within the grading limits shall be obtained from borrow areas.

3.3 DITCHES, GUTTERS, AND CHANNEL CHANGES

Ditches, gutters, and channel changes shall be cut accurately to the cross sections and grades indicated. All roots, stumps, rock, and foreign matter in the sides and bottom of ditches, gutters, and channel changes shall be trimmed and dressed or removed to conform to the slope, grade, and shape of the section indicated. Care shall be taken not to excavate ditches and gutters below the grades indicated. Excessive ditch and gutter excavation shall be backfilled to grade either with satisfactory, thoroughly compacted material or with suitable stone or cobble to form an adequate gutter paving as directed. All ditches and gutters excavated under this section shall be maintained until final acceptance of the work. Satisfactory material excavated from ditches and channel changes shall be placed in fill areas. Unsatisfactory and excess excavated material shall be disposed of in accordance with directions in paragraph EXCAVATION. No excavated material shall be deposited closer to the edges of the ditches than indicated and in no case less than 3 feet 1 meter.

3.4 BACKFILL ADJACENT TO STRUCTURES

Backfill adjacent to structures shall be placed and compacted uniformly in such manner as to prevent wedging action or eccentric loading upon or against the structures. Slopes bounding or within areas to be backfilled shall be stepped or serrated to prevent sliding of the fill. During backfilling operations and in the formation of embankments, equipment that will overload the structure in passing over and compacting these fills shall not be used. Backfill for storm drains and subdrains, including the bedding and backfill for structures other than culverts and drains, shall conform to the additional requirements in other applicable sections.

3.5 PREPARATION OF GROUND SURFACE FOR FILL

All vegetation, such as roots, brush, heavy sods, heavy growth of grass, and all decayed vegetable matter, rubbish, and other unsatisfactory material within the area upon which fill is to be placed, shall be stripped or otherwise removed before the fill is started. In no case will unsatisfactory material remain in or under the fill area. Sloped ground surfaces steeper than one vertical to four horizontal on which fill is to be placed shall be plowed, stepped, or broken up, as directed, in such manner that the fill material will bond with the existing surface. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried as may be required to obtain the specified moisture content and density.

3.6 FILLS AND EMBANKMENTS

Fills and embankments shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Satisfactory material obtained during excavation may be used in forming required fill. Fill shall be satisfactory material and shall be reasonably free from roots, other organic material, and trash and from stones having a maximum diameter greater than 6 inches. No frozen material will be permitted in the fill. Stones having a dimension greater than 4

inches 100 mm shall not be permitted in the upper 6 inches of fill or embankment. The material shall be placed in successive horizontal layers of [8] [_____] [12] inches [200] [_____] [300] mm in loose depth for the full width of the cross section and shall be compacted as specified. Each layer shall be compacted before the overlaying lift is placed. Moisture content of the fill or backfill material shall be adjusted by wetting or aerating, as required, to within plus or minus 3 percent of optimum moisture content as determined from laboratory tests specified in paragraph DEFINITIONS.

3.7 COMPACTION

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NOTE: Where the overall or overlot grading areas include roadways or other paved areas, the drawings will clearly indicate the locations and extent of the areas where compaction requirements suitable for paved areas will be required. Compaction requirements will be used to meet the particular condition. If there will be paved areas, the first choice below will be inserted or the second choice will be inserted if compaction requirements are not shown in tabular form on the plans:

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Except for paved areas, each layer of the fill or embankment shall be compacted to at least 90 percent of laboratory maximum density. Areas to be paved and other areas indicated as requiring compaction suitable for paved areas shall be compacted to at least 90 percent of maximum laboratory density and 95 percent of maximum laboratory density for the applicable ASTM D1557 and ASTM D 4253 procedure, respectively.

3.8 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth-graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials. For subgrade areas to be paved, the following shall be accomplished as required: (a) soft or otherwise unsatisfactory material shall be replaced with satisfactory excavated material or other approved materials; (b) rock encountered in the cut sections shall be excavated to a depth of 6 inches below finished grade for the subgrade; (c) low areas resulting from removal of unsatisfactory material or from excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and shall be compacted as specified. The surface of embankments or excavated areas for road construction or other areas on which a base course or pavement is to be placed shall vary not more than 0.05 foot 15 mm from the established grade and approved cross section. Surfaces other than those that are to be paved shall be finished not more than 0.15 foot 45 mm above or below the established grade or approved cross section.

3.9 PLACING TOPSOIL

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NOTE: Topsoil will be separated, excavated, stored, and used for surface finish in preparation for seeding, sodding, or other planting only where the topsoil is definitely superior for grass and other plant growth as compared to the balance of the excavated materials. Generally, topsoil will be spread after building and other operations have been completed. When topsoil spreading is covered under a separate section of the specifications, this paragraph will be deleted.

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On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 2-inch 50 mm depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of [_____] inches mm and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from [off-site areas] [areas indicated].

3.10 FIELD TESTING CONTROL

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NOTE: Field density tests are normally performed at a frequency of one test for every 5000 square feet of area being prepared. Other frequency intervals may be specified when conditions warrant.

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Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Moisture contents shall be determined in accordance with ASTM D 4643 and/or ASTM D 2216. If the ASTM D 4643 procedure is used, moisture contents shall be checked by the ASTM D 2216 procedure once per each 10 ASTM D 4643 tests. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2922. If ASTM D 2922 is used, in-place densities shall be checked by the ASTM D 1556 procedure at a frequency on one sand cone test for each 8 nuclear density tests and not less than one sand cone density test per lift. The sand cone test shall be performed adjacent to the location where a nuclear density test was performed to insure a proper correlation is established between the two density test procedures. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompacted to meet specification requirements, at no additional expense to the Government. Tests on recompacted areas shall be performed to determine conformance with specification requirements. The following number of

tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation. Field density and moisture content tests shall be performed at a frequency of once each [5,000] [ ]square feet [465] [ ] square meters per lift of fill placed.

3.10.1 Moisture Content

Moisture contents shall be determined on materials obtained from each density sample location.

3.10.2 Optimum Moisture and Laboratory Maximum Dry Density

The laboratory maximum dry density shall be determined from materials obtained at a sand cone test location using the appropriate procedure specified in Part 1 above. When ASTM D 1557 is used, the optimum moisture content shall be determined. A minimum of one laboratory maximum dry density test shall be run each placement day or fraction thereof. Additional laboratory maximum dry density tests shall be run for each material change.

3.11 PROTECTION

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NOTE: When required, erosion control materials and methods should be specified according to applicable provisions of Section 02935 TURF.

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Newly graded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes. All work shall be conducted in accordance with the environmental protection requirements of the contract.

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ADDITIONAL NOTES

NOTE A: For additional information on the use of all CEGS, see CEGS-01000 CEGS GENERAL NOTES.

NOTE B: This guide specification includes all excavating, grading, and associated operations that may be required under a construction contract, except excavating for buildings and utilities structures. Certain operations may not be applicable to the particular work or may be performed as subsidiary operations under other sections of the specifications. The Contracting Officer will delete any operations provided for in this specification that are not applicable to the work under consideration or that can be more expeditiously or advantageously performed under other sections. Each section will be modified as needed to fit local conditions. Where excavation for buildings or utilities systems is to be simultaneous with overlot grading, the priority of

each operation will be definitely stated, and bids secured accordingly, so that overlapping of operations or conflict regarding prices for the various types of excavation will not develop. The work of clearing and grubbing will be handled generally in a separate section and therefore has not been included under this section. Where clearing and grubbing are only incidental in amount, such work will be included by insertion of the necessary clearing and grubbing requirements in this section of the specifications, including any necessary provisions for measurement and payment and by suitable indications on the drawings.

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